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Re-evaluation Decision

Diazinon

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Re-evaluation Decision

After re-evaluation of the insecticide diazinon, Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is granting continued registration of some diazinon uses while requiring a phase-out of other uses of diazinon products for sale and use in Canada.

An evaluation of available scientific information found that, under the proposed conditions of use some uses of diazinon products have value in the food and crop industry, and do not entail a level of concern for human health or the environment. These uses include cattle ear tags and soil drench use on blackberry, broccoli, Brussels sprouts, cabbage, cauliflower, loganberry, onion, raspberry, rutabaga and turnip. As a condition of the continued registration of these uses, new risk-reduction measures must be included on the labels of certain diazinon products. In addition, the registrant must submit additional scientific information related to these uses.

The remaining uses of diazinon require a phase-out because registrants do not support their continued registration or because of human health risks, risks to the environment or both. Two different time frames, short term and longer term, were recommended considering the uses critical for crop production and the availability of alternative pest control options. Short term phase-out is recommended for non-critical uses for which registered alternatives are currently available. To remove these uses, a submission to amend the label for individual end-use products will be required within 90 days of finalization of this re-evaluation decision. For the critical uses that have value but no registered alternatives available, a longer term phase out is recommended. To remove these uses, a measured phase-out or transition framework to alternative risk management tools will be developed. The PMRA will consult with stakeholders to develop a risk management plan. Measures to further mitigate risk to workers and the environment will be implemented.

The risk assessments for diazinon were presented in two previous documents: Re-evaluation Note REV2005-06, *Preliminary Risk and Value Assessments of Diazinon* and a Proposed Re-evaluation Decision PRVD2007-16, *Diazinon.*[1] Comments on those documents were considered in the decision for diazinon. This Re-evaluation Decision[2] describes this stage of the PMRA's regulatory process for the re-evaluation of diazinon and summarizes the Agency's decision as well as the reasons for it. Appendix I summarizes the comments received during the consultation process and provides the PMRA's response to these comments. This decision is consistent with the proposed re-evaluation decision stated in PRVD2007-16. To comply with this decision, registrants of products containing diazinon will be informed of the specific requirements affecting their product registration(s) and of the regulatory options available to them.

For more details on the information presented in this Re-evaluation Decision, please refer to the Science Evaluation in the related Proposed Re-evaluation Decision PRVD2007-16.

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1 "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

2 "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

What Does Health Canada Consider When Making a Re-evaluation Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable[3] if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its conditions or proposed conditions of registration. The Act also requires that products have value[4] when used according to label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

To reach its decisions, the PMRA applies rigorous, modern hazard and risk assessment methods and policies. These methods consider the unique characteristics of sensitive segments of the population in both humans (for example, children) and organisms in the environment (for example, those most sensitive to environmental contaminants). These methods and policies also consider the nature of the effects observed and the uncertainties when predicting the impact of pesticides. For more information on how the PMRA regulates pesticides, as well as on the assessment process and risk-reduction programs, please visit the Pesticides and Pest Management portion of Health Canada's website at healthcanada.gc.ca/pmra.

What Is Diazinon?

Diazinon is an organophosphate insecticide used to control a broad range of insect pests on a wide variety of greenhouse food crops, terrestrial feed crops, terrestrial food crops, outdoor ornamental and nursery crops, livestock, non-crop land and on seeds as a protective seed treatment. It is applied using air blast, hydraulic sprayers (boom, backpack and handwand sprayers), granular applicators, paint brushes (in mushroom houses), seed treatment equipment and as slow-release ear tags for cattle. The following application methods were not assessed as they were not supported by the registrants: fogging in greenhouses and aerial application.

Background on the initial assessment of diazinon, including a summary of the uses, can be found in REV2005-06 and PRVD2007-16.

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3 "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act*.

4 "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (a) efficacy; (b) effect on host organisms in connection with which it is intended to be used; and (c) health, safety and environmental benefits and social and economic impact."

Health Considerations

Can Approved Uses of Diazinon Affect Human Health?

The assessment of human health aspects were discussed in REV2005-06. Additional risk-reduction measures are required on diazinon labels.

People could be exposed to diazinon by consuming food and water, working as a mixer/loader/applicator, handling treated nursery plants or entering treated sites. The PMRA considers two key factors when assessing health risks: the dose levels at which no health effects occur and the dose levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). Only those uses for which exposure is well below levels that cause no effects in animal testing are considered acceptable for continued registration. Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose at which no effects are observed.

Diazinon is of slight to moderate acute toxicity via oral exposure and of low acute toxicity via the dermal and inhalation routes of exposure. Diazinon is mildly irritating to the skin, minimally irritating to the eye and is considered a skin sensitizer.

An overexposure to diazinon inhibits the enzyme acetylcholinesterase, interrupting the transmission of nerve impulses. It works by contact, ingestion and vapour action. Symptoms such as tremors, salivation and shortness of breath may occur after diazinon exposure in animals and humans. Diazinon is rapidly absorbed and excreted and does not accumulate in tissues. Accordingly, exposure to diazinon in adult animals produced neurobehavioural symptoms soon after exposure. However, there were no significant structural changes to the brain, spinal cord or peripheral nerve after any exposure.

Toxic effects on development and reproduction were observed in animals but only at very high doses that were also toxic to the mother, indicating that there is no additional sensitivity of the young. Diazinon given to pregnant animals did not result in any structural developmental changes to the fetus. Diazinon was not genotoxic and did not cause cancer in animals. The risk assessment is conducted to ensure that the level of human exposure is well below the lowest dose at which effects occurred in animal tests.

Residues in Water and Food

Dietary risks from food and water are not of concern.

Reference doses define levels to which an individual can be exposed over a single day (acute) or lifetime (chronic) and expect no adverse health effects. Generally, dietary exposure from food and water is acceptable if it is less than 100% of the acute reference dose or chronic reference dose (acceptable daily intake). An acceptable daily intake is an

estimate of the level of daily exposure to a pesticide residue that, over a lifetime, is believed to have no significant harmful effects.

Human exposure to diazinon, including that of the most highly exposed subpopulation (for example, children 1 to 6 years old), was estimated from residues in treated food commodities. This dietary exposure represents less than 76% of the acute reference dose and less than 31% of the chronic reference dose. Based on the available surveillance data, exposure that may occur from drinking water is not of concern. However, additional confirmatory data are required.

The *Food and Drugs Act* prohibits the sale of adulterated food, that is, food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for the *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Each MRL value defines the maximum concentration in parts per million (ppm) of a pesticide allowed in/on certain foods. Food containing a pesticide residue that does not exceed the established MRL does not pose an unacceptable health risk.

MRLs for diazinon are currently specified for apples, apricots, beans, beets, broccoli, Brussels sprouts, cabbage, cantaloupes, carrots, cauliflower, celery, cherries, citrus fruits, collards, cranberries, cucumbers, endives, figs, grapes, hops, kale, kohlrabi, lettuce, Lima beans, muskmelons, onions, parsley, parsnips, peaches/nectarines, pears, peppers, plums, radishes, salsify, spinach, strawberries, summer squash, Swiss chard, tomatoes, turnip tops, turnips, wasabi, watermelons, winter squash or processed foods derived from these foods. MRLs for residues of diazinon on apples, apricots, Brussels sprouts, carrots, cherries, cranberries, grapes, onions, parsnips, peaches/nectarines, peach, pears, peppers, plums, prune, radishes, strawberries, turnip tops and turnips will be maintained during their respective phase-out periods.

Where no specific MRL has been established, a default MRL of 0.1 ppm applies, which means that pesticide residues in a food commodity must not exceed 0.1 ppm. However, changes to this general MRL may be implemented in the future, as indicated in Discussion Document DIS2006-01, *Revocation of 0.1 ppm as a General Maximum Residue Limit for Food Pesticide Residues [Regulation B.15.002(1)]*. If and when this general MRL is revoked, a transition strategy will be established to allow a permanent MRL to be set.

Risks in Residential and Other Non-Occupational Environments

Residential and other non-occupational risks are not of concern.

Diazinon can no longer be used in and around homes or other residential areas such as parks, school grounds and playing fields. Therefore, no residential or other non-occupational risks are expected.

Occupational Risks From Handling Diazinon

Occupational risks are of concern for mixer/loader/applicators with high exposure activities and are not of concern to other mixer/loader/applicators provided additional risk-mitigation measures are observed.

Based on both the precautions and directions for use on the original product labels reviewed for this re-evaluation and additional protective equipment and measures, the risk estimates associated with applying, mixing and loading for high exposure activities did not meet current standards for several use scenarios and are of concern.

The use scenarios of concern include seed treatment, airblast, some hand-held equipment, and indoor applications for mushroom and tobacco crops.

Other use scenarios, such as ear tags for cattle and application by groundboom for most crops, are not of concern. Additional protective measures to reduce exposure to mixer/loader/applicators are required for continued registration of these uses.

Occupational postapplication risks are not of concern provided additional risk-reduction measures are observed.

Postapplication occupational risk assessments consider exposures to workers re-entering treated sites in agriculture. Based on the precautions and directions for use on the current product labels, postapplication non-cancer risks to re-entry workers performing high-exposure activities, such as thinning, pruning and harvesting of most crops, did not meet current standards and are of concern. Additional protective measures to reduce exposure to workers entering treated areas are required. These measures, in addition to protective equipment, include revised restricted-entry intervals.

Environmental Considerations

What Happens When Diazinon Is Introduced Into the Environment?

Further to an earlier assessment (REV2005-06), a more refined assessment has confirmed diazinon poses a potential risk to pollinators, birds, small wild mammals, aquatic invertebrates, amphibians and fish. Therefore, additional risk-reduction measures are required.

Diazinon released into the environment can be found in soil, surface water, air and rain. Diazinon will volatilize from moist surfaces and water. Diazinon is slightly persistent in soils and non-persistent in aquatic systems. Diazinon has a moderate potential for mobility in a variety of soil types. Available Canadian monitoring data indicate that diazinon reaches surface water readily. Field studies indicate that diazinon does not leach below 30 cm of soil depth. Oxypyrimidine was identified as the primary transformation

product and was observed to leach to a depth of 180 cm, which may be a concern for groundwater contamination.

Foliar applications of diazinon are a concern for pollinators, birds and small herbivorous wild mammals feeding on the site of application, as well as some sizes and food guilds of birds and small herbivorous wild mammals feeding in terrestrial habitats adjacent to the site of some applications. Foliar applications of diazinon are also a concern for aquatic invertebrates, amphibians, and fish from residues in spray drift, based on Canadian surface water monitoring data that comprises all sources of exposure including spray drift and runoff.

Granular applications of diazinon are of high risk to small birds and wild mammals since the consumption of very few granules (five granules for a small bird) is required to reach the dose causing 50% mortality in the test population (LD_{50}). Field studies conducted in the United States have demonstrated that granular applications of diazinon can adversely affect birds and small wild mammals in the treatment area.

Seed treatments also pose a high risk to small birds because the number of treated seeds that need to be consumed to reach the LD_{50} is very small (1 to 20 seeds).

Value Considerations

What Is the Value of Diazinon?

The value of diazinon was discussed in REV2005-06, *Preliminary Risk and Value Assessments of Diazinon* and stakeholder comments were requested.

In response to REV2005-06, stakeholders identified uses that were considered of value in addition to those identified in this document (see PRVD2007-16).

Further comments in response to PRVD2007-16 were received regarding the value of diazinon for certain crops. The comments were evaluated for the purpose of refining the proposed phase-out scenarios for different uses, as identified in Appendix IV of PRVD2007-16. As a result, the phase-out period has been revised from short term to longer term for foliar application on the following crops:

- apricot
- peach
- pear
- plum
- prune

Revised phase-out periods are listed in Appendix II.

Measures to Minimize Risk

As a result of this re-evaluation, granular products, foliar application and seed treatments using diazinon will be phased out.

The labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law.

As a result of the re-evaluation of diazinon, the PMRA is requiring further risk-reduction measures on product labels. These measures, in addition to those already found on existing diazinon product labels, are designed to further protect human health and the environment. Registrants will be required to amend their product labels to reflect these additional measures.

Human Health

- Additional personal protective equipment and engineering controls are required to protect workers.
- Restricted-entry intervals are required to protect workers re-entering treated sites.

Environment

- Additional precautionary statements and directions for use are required, as well as buffer zones to protect non-target freshwater and estuarine and marine invertebrates, fish and amphibians.
- Additional precautionary statements to protect birds, small wild mammals, bees and other insects are required.
- Additional precautionary statements are required to protect aquatic habitats from use on sites conducive to runoff.

Label amendments are listed in Appendix III.

What Additional Scientific Information Is Required

Data are required as a condition of continued registration under section 12 of the *Pest Control Products Act*. The registrants of this active ingredient must provide data or acceptable scientific rationale to the PMRA on the subject of developmental neurotoxicity in relation to diazinon.

Diazinon is a neurotoxicant in adult animals, with acetylcholinesterase inhibition as the most sensitive endpoint of concern. The toxicology database lacks a developmental neurotoxicity study, which is required in order to refine the toxicology risk assessment. The developmental neurotoxicity study must include assessments of acetylcholinesterase activities in the maternal animals and offspring. It must also be conducted according to the appropriate United States Environmental Protection Agency's Office of Prevention, Pesticides and Toxic Substances or Organisation for Economic Co-operation and Development guidelines, in addition to protocol requirements.

Next Steps

The PMRA has determined that many uses of diazinon are to be phased out. Two different time frames, short term and longer term, were recommended considering the critical uses and availability of alternatives (see Appendix II). A submission to request label amendments for individual end-use products to remove these short term uses will be required within 90 days of finalization of the re-evaluation decision.

For the critical uses requiring a longer term phase-out, a measured phase-out and/or a transition framework to alternative risk management tools will be developed. Although a target of 2012 was recommended in proposed decision (PRVD2007-16), this may not be appropriate for all uses. The PMRA will develop a risk management plan in consultation with stakeholders. The PMRA will update stakeholders by publishing documents explaining the risk management plan. Input will be requested from the registrants and the stakeholders including: i) quantitative and/or qualitative data on the socio-economic impact of the phase-out of diazinon to specific industries, and ii) confirmatory scientific information to establish feasible phase-out dates. In the interim, measures to mitigate risk to workers and the environment will be implemented for these uses, as well as for remaining uses on the label.

Other Information

For diazinon, the summaries of assessments found in PRVD2007-16 and REV2005-06 serve as evaluation reports. Lists of references considered by the Agency in support of the registration decision are found in this Re-evaluation Decision. The relevant test data on which the decision is based are available for public inspection, upon application, in the PMRA's Reading Room (located in Ottawa). For more information, please contact the PMRA's Pest Management Information Service.

Any person may file a notice of objection regarding this decision on diazinon within 60 days of the date of publication of this Re-evaluation Decision. For more information regarding the basis for objection (which must be based on scientific grounds), please refer to the Pesticides and Pest Management portion of Health Canada's website (Request a Reconsideration of Decision) or contact the PMRA's Pest Management Information Service.

Appendix I Comments and Responses

Comments Pertaining to Value Assessment

Comments regarding the value of diazinon uses were received from provinces, registrants and grower associations by the PMRA in response to PRVD2007-16. The comments were evaluated for the purpose of refining the proposed phase-out criteria by use site identified in Appendix IV of PRVD2007-16. As a result, the proposed phase-out period was revised from short term to longer term for foliar applications to apricot, peach, pear, plum and prune.

1.0 General Comment on the Value of Diazinon

1.1 Comment

There are no registered alternatives for several uses of diazinon. Phase-out for these uses should be reconsidered for longer term.

Response

Appendix IV in PRVD2007-16 identified crops needing a longer term phase-out; these are potential candidates for a transition strategy. Based on comments received in response to PRVD2007-16, apricot, peach, pear, plum and prune have also been identified for longer term phase-out.

1.2 Comment

Diazinon is an important integrated pest management tool. Alternative products need to be identified and registered before certain uses of diazinon are no longer available. Transition strategies need to be developed and communicated to agricultural stakeholders.

Response

For certain crops identified in the value review of diazinon, transition strategies have previously been initiated in response to the phase-out of other active ingredients (for example, azinphos-methyl, terbufos). Transition strategies are being developed on a commodity basis and any potential changes, such as loss of diazinon, will be incorporated into that work. Although transition strategies are initiated in response to concerns over the loss of specific uses of an active ingredient, uses common to more than one active ingredient will be addressed under the same transition strategy. Thus, some uses of diazinon for which there are no viable alternative active ingredients or that are critical for production of a crop will be considered in the transition strategies that have already been initiated.

Where a transition strategy has not yet been initiated for a particular use, this need will be reviewed and discussed with stakeholders.

1.3 Comment

The proposed phase-out date of 2012 should be extended where needed, based upon available alternatives to diazinon.

Response

The PMRA recognizes that for some crops where alternative active ingredients to diazinon are limited and where both diazinon and azinphos-methyl are widely used, such as cranberry, the phase-out of diazinon and azinphos-methyl in the same growing season may not be feasible. The PMRA will develop a feasible risk management plan in consultation with stakeholders.

1.4 Comment

Diazinon is required for use on various crops since the broad spectrum control of pests allows for effective suppression of secondary pests and prevents shifts in pest complexes.

Response

The PMRA recognizes the value of diazinon as a broad spectrum pest control product and its role in integrated pest management practices for several crops. The need for broad spectrum pest control products in some crops is being addressed in ongoing transition strategies. The initiation of transition strategies will be discussed with stakeholders where a need has been identified and a transition strategy has not yet been initiated.

2.0 Comments on the Use of Diazinon on Apples

Comments regarding the value of diazinon use on apples provided in response to REV2005-06 were considered. As a result of the evaluation of these comments, apple was identified in PRVD2007-16 as a crop needing a longer term phase-out. A transition strategy has been initiated for apples as a result of the phase-out of azinphos-methyl (REV2007-08).

2.1 Comment

Woolly apple aphid control represents the most significant use of diazinon in Ontario. Several alternative insecticides registered for the control of apple aphid, woolly apple aphid and rosy apple aphid are under re-evaluation. Alternatives from more than one resistance mode of action (MoA) group are required for resistance management.

Response

Consideration of the value of diazinon for the control of woolly apple aphid led to the choice of longer term phase-out for this crop. Alternative active ingredients to diazinon from resistance MoA groups 1A and B, 2A, 3, and 4 are available for rotation for the purposes of resistance management of green apple aphid, rosy apple aphid and woolly apple aphid (see Table 1.0). The PMRA acknowledges there are limitations to the alternative active ingredients.

2.2 Comment

Use of diazinon to control mullein bug was not recognized in PRVD2007-16. Alternatives from more than one resistance MoA group are required for resistance management. Diazinon is chosen by growers for postbloom application as it has a low impact on [predatory] mite populations.

Response

Use of diazinon on apples for the control of mullein bug was discussed in REV2005-06 and was identified as a "key use". Alternative active ingredients to diazinon from resistance MoA groups 1A, 3 and 4 are available for rotation for the purpose of resistance management of mullein bug (*Campylomma sp.*) and are listed in Table 1.0.

The PMRA acknowledges that there are limitations to the registered alternative active ingredients to diazinon. Apple is identified as a crop needing a longer term phase-out due to this use. A transition strategy for apple has been initiated as a result of the phase-out of azinphos-methyl (REV2007-08).

2.3 Comment

Diazinon is the only active ingredient recommended as a summer spray in British Columbia for the control of European fruit scale and San Jose scale on apples.

Response

Registered alternatives to diazinon for the control of scale insects on apples are listed in Table 1.0. For control of European fruit scale as a summer spray, the only viable alternative active ingredient to diazinon is malathion. The PMRA acknowledges that there are limitations to the registered alternative active ingredients to diazinon.

Table 1.0 Registered Alternative Active Ingredients to Diazinon on Apple Based on the Currently Registered Insecticide Labels in Canada.

Pest	Registered alternative active ingredients to diazinon [1, 2]	Comments
Apple aphid, rosy apple aphid,	1A: methomyl, oxamyl (non-bearing), pirimicarb (Eastern Canada only) 1B: malathion, phosalone, phosmet 2A: endosulfan 3: deltamethrin, lambda-cyhalothrin 4: acetamiprid, imidacloprid (green and rosy apple aphids), thiamethoxam (rosy apple aphid only) Other: insecticidal soap	Carbaryl, endosulfan, malathion, methomyl, oxamyl and phosmet are currently under re-evaluation (PMRA, 2008). Use of pirimicarb on apple is not supported by the technical registrant. All uses of pirimicarb will expire December 31, 2009 (PMRA, 2008). Use of phosalone on apple is not supported by the technical registrant. All uses of phosalone are to be phased out by September 30, 2012 (PMRA, 2008). The preliminary risk assessment for endosulfan indicates a level of concern for workers and the environment (REV2007-13).
Woolly apple aphid	1A: carbaryl, methomyl, pirimicarb (eastern Canada only) 1B: malathion, phosalone, phosmet 2A: endosulfan 3: deltamethrin, lambda-cyhalothrin 4: acetamiprid Other: insecticidal soap	
Mullein bug	1A: methomyl 1B: azinphos-methyl 3: cypermethrin, deltamethrin, permethrin 4: imidacloprid, thiacloprid, thiamethoxam	
San Jose scale	1A: carbaryl 1B: azinphos-methyl, malathion (scale crawlers), phosmet Other: insecticidal soap, mineral oil, lime sulphur	Carbaryl, malathion and phosmet are currently under re-evaluation (PMRA, 2008). Mineral oil and lime sulphur are limited to early season use. Due to the short residual activity and the potential for phytotoxicity from repeated applications (Caldwell, *et al,* 2005; Kowalsick, 2003) insecticidal soap is not considered a viable alternative.
European fruit scale	1B: malathion (scale crawlers) Other: insecticidal soap, mineral oil, lime sulphur	

[1] This is a list of registered alternatives only (as of June, 2008). Health Canada does not endorse any of the alternatives listed. A number of the listed alternative active ingredients are in the process of being re-evaluated by the PMRA. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the *Re-evaluation Summary Table* (PMRA, 2008).

[2] Insecticide and Acaricide Resistance Management Group Numbers are based on DIR 99-06, with updates from the Insecticide Resistance Action Committee (IRAC) website: www.irac-online.org/Crop_Protection/MoA.asp#area223. 1A = acetylcholinesterase inhibitors (carbamates); 1B = acetylcholinesterase inhibitors (organophosphates); 2A = gamma-aminobutyric acid (GABA)-gated chloride channel antagonists; 3 = sodium channel modulators; and 4 = acetylcholine receptor agonists/antagonists.

3.0 Comment on the Use of Diazinon on Cranberry

Comments regarding the value of diazinon for use on cranberry were provided to the PMRA in response to REV2005-06. As a result of the evaluation of the comments, cranberries were identified as a crop with a need for a longer term phase-out. Additionally, a transition strategy was initiated for cranberry due to the phase-out of azinphos-methyl (REV2007-08). Comments provided to the PMRA in response to PRVD2007-16 confirm the need for longer term phase-out of diazinon on cranberry.

3.1 Comment

Diazinon is an important pest management tool for a number of labelled pests. A broad spectrum pest control product is required to suppress secondary pests and sporadic pests. Diazinon is critical for rotation with tebufenozide to delay the development of resistance in lepidopteran pests (butterflies and moths). The majority of the registered alternative active ingredients to diazinon are currently under re-evaluation. Before the longer term phase-out occurs, effective alternative products need to be available to growers to use.

Response

The PMRA acknowledges that there are limitations to the registered alternative active ingredients to diazinon. Table 2.0 identifies these.

Table 2.0 Registered alternative active ingredients to diazinon for control of cranberry pests in Canada.

Pest	Registered alternative active ingredients to diazinon [1, 2]	Comments
Cranberry fruitworm	1A: carbaryl 1B: azinphos-methyl, malathion 5: spinosad (suppression only)	Of the registered alternative active ingredients to diazinon, all the registered alternatives with the exception of tebufenozide and spinosad are currently under re-evaluation (PMRA, 2008). Acephate is registered to control the first generation of blackheaded fireworm only. Azinphos-methyl is to be phased out by 2012 (RRD2004-05; REV2007-08). Diazinon is required for rotation with tebufenozide to delay the development of resistance in blackheaded fireworm and *Sparganothis* fruitworm.
Blackheaded fireworm	1A: carbaryl 1B: acephate, azinphos-methyl, malathion, phosmet 18: tebufenozide	
Sparganothis fruitworm	1B: azinphos-methyl 18: tebufenozide	

Pest	Registered alternative active ingredients to diazinon [1, 2]	Comments
Dearness scale	Other: insecticidal soap	This use of diazinon was registered through the Minor Use Label Expansion (URMULE) Program in 2005. Due to the short residual activity and the potential for phytotoxicity from repeated applications (Caldwell, *et al,* 2005; Kowalsick, 2003) insecticidal soap is not considered a viable alternative.

1 This is a list of registered alternatives only (as of June, 2008). Health Canada does not endorse any of the alternatives listed. A number of the listed alternative active ingredients are in the process of being re-evaluated by the PMRA. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the *Re-evaluation Summary Table* (PMRA, 2008).

2 Insecticide and Acaricide Resistance Management Group Numbers are based on DIR 99-06, with updates from the Insecticide Resistance Action Committee (IRAC) website: www.irac-online.org/Crop_Protection/MoA.asp#area223. 1A = acetylcholinesterase inhibitors (carbamates); 1B = acetylcholinesterase inhibitors (organophosphates); 5 = acetylcholine receptor modulators and 18 = ecdysone agonist/disruptors.

4.0 Comment on the Use of Diazinon on Currants and Gooseberries

There is increasing interest for currants and gooseberries:

- as an additional crop for fruit growers;
- to supply domestic demand for locally produced berries; and
- for the wine industry.

Diazinon is the only active ingredient available to control sawfly on currants and gooseberries.

Response

Comments regarding the value of diazinon for use on currants and gooseberries were provided to the PMRA in response to REV2005-06. The alternative active ingredients to diazinon for the control of aphids, lecanium scale and sawflies on currants and gooseberries were identified in Appendix III of PRVD2007-16. The PMRA concurs that there are no registered alternative active ingredients in Canada for the control of lecanium scale and sawflies on currants and gooseberries, and there is only one registered alternative active ingredient (malathion) for the control of aphids on these crops. Malathion is currently under re-evaluation.

Based on a review of the comments received in response to REV2005-06, currants and gooseberries were identified as crops needing a longer term phase-out and transition strategy.

5.0 Comments on the Use of Diazinon on Raspberries

5.1 Comment

PRVD2007-16 does not recognize the importance of diazinon for the control of raspberry sawfly or fruitworms.

Response

The value of the use of diazinon on raspberries for the control of raspberry sawfly and fruitworms was discussed in REV2005-06. These uses were identified as "key uses".

Additionally, comments regarding the value of diazinon for the control of raspberry crown borer, aphids, leafhoppers and thrips were received in response to REV2005-06. In acknowledgement of the value of the diazinon uses, raspberries were identified as a crop needing a longer term phase-out. A transition strategy was initiated for raspberries due to the phase-out of azinphos-methyl (REV2007-08).

5.2 Comment

Diazinon is required to control crown borer on raspberries for the following reasons:

- Yield losses from this pest are severe—this pest kills the plant.
- Azinphos-methyl is the only registered alternative to diazinon.

Response

This use of diazinon is discussed in REV2005-06, where it was identified as a "key use". Note diazinon is applied as a drench to control this pest. Drench applications of diazinon are not proposed for phase-out.

6.0 Comment on Seed Treatment Use of Diazinon—Field Crops

6.1 Comment

Diazinon is co-formulated with captan and thiophanate-methyl in DCT Dual Purpose Seed Treatment (Registration Number 14986). This is the only product registered for use on soybeans and dry beans for the control of anthracnose.

Response

Seed treatment uses of diazinon are not supported by the technical registrants. DCT Dual Purpose Seed Treatment is not registered on soybeans. There is, however, a registered alternative seed treatment product to DCT Dual Purpose Seed Treatment also containing captan and thiophanate-methyl for the control of anthracnose on dry beans.

7.0 Comment on the Use of Diazinon in Mushroom Houses

7.1 Comment

Mushroom growers need access to the use of diazinon for management of flies and as a resistance management tool.

Response

Registered alternative active ingredients for the control of phorid and sciarid flies in mushroom houses include the following resistance management MoAs:

- MoA group 1B insecticides: dichlorvos (fog), malathion (aerosol)
- MoA group 3 insecticides: permethrin (fog), pyrethrins (fog)
- MoA group 7 insecticides: s-methoprene (control of sciarid flies only–mixed into growth media or casing material)
- MoA group 17 insecticides: cyromazine (control of sciarid flies only–in compost or casing material)

8.0 Comment on the Use of Diazinon on Turf

The PMRA has received comments supporting the use of diazinon as a soil drench for the control of grubs in turf.

Response

Use of diazinon for the control of grubs in turf has been previously phased out as detailed in REV2000-08.

9.0 Comments on the Use of Diazinon on Stone Fruit

Comments were received regarding the value of diazinon to control pests on apricots, peaches, plums and prunes. It was requested that a longer term phase-out period be considered.

Response

Based on the review of the comments received, the required phase-out period of diazinon use on apricots, peaches, plums and prunes has been revised to longer term.

9.1 Comment

Diazinon is needed to manage peach twig borer on peaches, apricots and nectarines.

Response

The registered alternative active ingredients to diazinon for the control of peach twig borer on apricot, peach, plum and prune are listed in Table 3.0. Diazinon is not registered for use on nectarines in Canada. The PMRA concurs that there are few viable registered alternative active ingredients registered for the control of peach twig borer on stone fruit crops.

Table 3.0 Registered Alternatives to Diazinon for the Control of Peach Twig Borer on Stone Fruit.

Crop	Registered alternative active ingredients to diazinon [1, 2]	Comments
Apricot	1A: carbaryl 1B: azinphos-methyl 2A: endosulfan 28: chlorantraniliprole	Carbaryl, endosulfan and phosmet are currently under re-evaluation (PMRA, 2008). Azinphos-methyl is to be phased out for use on apricot, peach, plum and prune by 31 December 2012 (RRD2004-05; REV2007-08). Use of phosalone on peach is not supported by the technical registrant. All uses of phosalone are to be phased out by 30 September 2012 (PMRA, 2008). The preliminary risk assessment for endosulfan indicates a level of concern for workers and the environment (REV2007-13). Deltamethrin is registered for use on peaches only. Repeated use of synthetic pyrethroids contributes to secondary pest outbreaks (for example, mites). Chlorantraniliprole was registered as of 1 May 2008 for use on stone fruit to control peach twig borer. Experience with this newly-registered active ingredient is required to identify how best to integrate its use into current pest management practices.
Peach	1A: carbaryl 1B: azinphos-methyl, phosalone, phosmet 2A: endosulfan 3: deltamethrin 28: chlorantraniliprole Other: lime sulfur	
Plum	1A: carbaryl 1B: azinphos-methyl 2A: endosulfan 28: chlorantraniliprole	
Prune	1A: carbaryl 1B: azinphos-methyl 28: chlorantraniliprole	

[1] This is a list of registered alternatives only (as of June, 2008). Health Canada does not endorse any of the alternatives listed. A number of the listed alternative active ingredients are in the process of being re-evaluated by the PMRA. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the *Re-evaluation Summary Table* (PMRA, 2008).

[2] Insecticide and Acaricide Resistance Management Group Numbers are based on DIR 99-06, with updates from the Insecticide Resistance Action Committee (IRAC) website: www.irac-online.org/Crop_Protection/MoA.asp#area223. 1A = acetylcholinesterase inhibitors (carbamates); 1B = acetylcholinesterase inhibitors (organophosphates); 2A = gamma-aminobutyric acid (GABA)-gated chloride channel antagonists; 3 = sodium channel modulators; and 28 = ryanodine receptor modulator.

9.2 Comment

Diazinon is required for early season use in combination with mineral oil, and by itself later in the season, for the control of San Jose scale.

Response

The registered alternative active ingredients to diazinon for the control of San Jose scale on apricot, peach, plum and prune are listed in Table 4.0. The PMRA concurs that there are few viable alternative active ingredients registered for the control of San Jose scale on stone fruit crops.

For early season control of San Jose scale, the only registered tank mix alternative to diazinon for use with mineral oil is lime sulphur on plums and prunes only.

Table 4.0 Registered Alternatives to Diazinon for the Control of San Jose Scale on Stone Fruit.

Crop	Registered alternative active ingredients to diazinon [1, 2]	Comments
Apricot	1A: carbaryl 1B: azinphos-methyl, malathion Other: mineral oil, insecticidal soap	Carbaryl and malathion are currently under re-evaluation (PMRA, 2008). Azinphos-methyl is to be phased out for use on apricot, peach, plum and prune by 31 December 2012 (RRD2004-05; REV2007-08). Due to the short residual activity and the potential for phytotoxicity from repeated applications (Caldwell, et al. 2005; Kowalsick, 2003) insecticidal soap is not considered a viable alternative. Lime sulphur and mineral oil are limited to use for early season control.
Peach	1A: carbaryl 1B: azinphos-methyl Other: lime sulphur, mineral oil, insecticidal soap	
Plum, prune	1A: carbaryl 1B: azinphos-methyl Other: lime sulphur, mineral oil, insecticidal soap	

1 This is a list of registered alternatives only (as of June, 2008). Health Canada does not endorse any of the alternatives listed. A number of the listed alternative active ingredients are in the process of being re-evaluated by the PMRA. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the *Re-evaluation Summary Table* (PMRA, 2008).

2 Insecticide and Acaricide Resistance Management Group Numbers are based on DIR 99-06, with updates from the Insecticide Resistance Action Committee (IRAC) website: www.irac-online.org/Crop_Protection/MoA.asp#area223. 1A = acetylcholinesterase inhibitors (carbamates); and 1B = acetylcholinesterase inhibitors (organophosphates).

9.3 Comment

Diazinon is required to control aphids on apricots.

Response

Diazinon use on apricots was not identified as a "key use" in REV2005-06, nor were comments received supporting this use. As of June 2008, the registered alternatives to diazinon for the control of aphids on apricots are:

- malathion (MoA group 1B);
- endosulfan (black cherry aphid, mealy plum aphid, green peach aphid) (MoA group 2A); and
- insecticidal soap.

The PMRA acknowledges that there are limitations to the currently registered alternative active ingredients to diazinon.

10.0 Comments on the Use of Diazinon on Radish

The use of diazinon to control aphids and root maggots (cabbage maggot and seedcorn maggot) on radish was identified among "key uses" in REV2005-06. The public comments supported the control of root maggots, but not aphids, as a "key use".

10.1 Comment

Diazinon is critical for the management of root maggots on radish.

Response

Diazinon is registered for the control of root maggots (cabbage maggot and seedcorn maggot) as a seed treatment and a granular application in furrow. Granular application is preferred over seed treatment, as the latter results in reduced emergence. Seed treatment application of diazinon to radish is not supported by the registrants and has been identified for short term phase-out. Granular application of diazinon to radish has been identified for longer term phase-out.

Chlorpyrifos (MoA group 1B) is the only registered alternative active ingredient for the control of cabbage maggot. There are no registered alternative active ingredients for the control of seedcorn maggot. For all crops identified for longer term phase-out, where a transition strategy has not yet been initiated, the need for one will be reviewed and discussed with stakeholders.

10.2 Comments on the Phase-out of Foliar Application

A comment was received in response to PRVD2007-16 stating that the phase-out of foliar applications should be longer term.

Response

Comments received in response to PRVD2007-16 differed from those provided in response to REV2005-06. Comments provided in response to REV2005-06 regarding the value of diazinon use on radish as a foliar spray did not support the control of aphids as a "key use". Additionally, comments indicated that of the pests registered for control by a foliar application of diazinon to radish, flea beetle was of greatest concern. Carbaryl, malathion and permethrin are currently registered to control flea beetles on radishes. Based on the review of the comments received in response to REV2005-06 and PRVD2007-16, the use of diazinon as a foliar spray remains for short term phase-out.

11.0 Comments on the Use of Diazinon on Beans

The PMRA has received comments regarding the use of diazinon on beans (dry, field and green, succulent) for the control of aphids.

Response

Diazinon was not identified as a "key use" for the control of aphids on beans in REV2005-06 and no comment was received in response to REV2005-06 indicating that this use of diazinon was critical. The currently registered alternative active ingredients to diazinon for the control of aphids on beans are listed in Table 5.0. The PMRA acknowledges that there may be limitations to the use of the currently registered alternative active ingredients to diazinon.

Table 5.0 Registered Alternative Active Ingredients to Diazinon for the Control of Aphids on Beans.

Registered alternative active ingredients to diazinon [1, 2]	Comments
1B: malathion, dimethoate	These active ingredients are currently under re-evaluation.
1B: naled	Registered for use on dry beans, field beans and lima beans. The re-evaluation of naled is complete. Use of naled is to continue on dry beans and lima beans for the control of aphids as per the use standard published in RRD2006-24.
2A: endosulfan	Registered for the control of bean aphid and black bean aphid on beans. Endosulfan is not for use on lima beans due to phytotoxicity. Endosulfan is currently under re-evaluation. The preliminary risk assessment for endosulfan indicates a level of concern for workers and the environment REV2007-13.
3: lambda-cyhalothrin	Registered for use on favabeans (broad beans) for the control of pea aphid.
Other: insecticidal soap	Due to the short residual activity and the potential for phytotoxicity from repeated applications (Caldwell, *et al,* 2005; Kowalsick, 2003) insecticidal soap is not considered a viable alternative.

[1] This is a list of registered alternatives only (as of June, 2008). Health Canada does not endorse any of the alternatives listed. A number of the listed alternative active ingredients are in the process of being re-evaluated by the PMRA. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the *Re-evaluation Summary Table* (PMRA, 2008).

[2] Insecticide and Acaricide Resistance Management Group Numbers are based on DIR 99-06, with updates from the Insecticide Resistance Action Committee (IRAC) website: www.irac-online.org/Crop_Protection/MoA.asp#area223. 1B = acetylcholinesterase inhibitors (organophosphates); 2A = gamma-aminobutyric acid (GABA)-gated chloride channel antagonists; and 3 = sodium channel modulators.

12.0 Comment on the Use of Diazinon on Cherry

Loss of diazinon for use to control black cherry aphid, cherry fruit fly and mealy bugs on cherry was identified as a concern in response to REV2005-06. Concerns were reiterated in response to PRVD2007-16. Additionally, concern regarding the potential loss of diazinon for the control of eyespotted bud moth was identified in PRVD2007-16.

Response

Based on the evaluation of the comments received in response to REV2005-06, cherry was identified in PRVD2007-16 as a crop needing a longer term phase-out. This was confirmed by comments received in response to the PRVD. A transition strategy has been initiated for cherry as a result of the phase-out of azinphos-methyl (REV2007-08).

13.0 Comment on the Use of Diazinon on Pears

The PMRA received comments in response to PRVD2007-16 regarding the value of the uses of diazinon to control San Jose scale, green fruitworm and eyespotted bud moth on pear.

Response

Diazinon use on pear was not identified as a "key use" in REV2005-06 and no comment was received in response to REV2005-06 indicating that use of diazinon was critical. However, the PMRA received comments in response to PRVD2007-16 regarding the value of the use of

diazinon to control insect pests on pears. The PMRA acknowledges that there are limitations to the use of the currently registered alternative active ingredients to diazinon. A transition strategy has been initiated for pear as a result of the phase-out of azinphos-methyl (REV2007-08). Based on the evaluation of comments received, the short term phase-out of diazinon use on pear is now proposed for longer term phase-out.

13.1 Comment

Diazinon is required for use with mineral oil for the control of San Jose scale, and for rotation with registered alternative active ingredients to delay the development of resistance for the control of eyespotted bud moth and green fruitworm on pears.

Response

The PMRA acknowledges that there are limitations to the use of the currently registered alternative active ingredients to diazinon and that the tank mix of diazinon with mineral oil is of value for early season control of San Jose scale. The registered alternative active ingredients to diazinon for the control of San Jose scale, eyespotted bud moth and green fruitworm are listed in Table 6.0.

Table 6.0 Registered Alternative Active Igredients to Diazinon for the Control of San Jose Scale, Green Fruitworm and Eyespotted Bud moth on Pears.

Pest	Registered alternative active ingredients to diazinon [1, 2]	Comments
San Jose scale	1A: carbaryl (scale crawlers) 1B: azinphos-methyl, malathion (scale crawlers) Other: lime sulphur, mineral oil	The re-evaluation of *Bacillus thuringiensis* var *kurstaki* is complete. *Bacillus thuringiensis* var *kurstaki* was granted continued registration for sale and use in Canada (RVD2008-18). Carbaryl, malathion and phosmet are currently under re-evaluation (PMRA, 2008). Azinphos-methyl is to be phased out for use on pear by 31 December 2012 (RRD2004-05; REV2007-08). Repeated applications of synthetic pyrethroids may lead to mite outbreaks (Carter *et. al*, 2007). Lime sulphur and mineral oil are limited to use for early season control.
Green fruitworm	1A: carbaryl 1B: azinphos-methyl, phosmet 3: cypermethrin, permethrin (eastern Canada only) 11: *Bacillus thuringiensis* var *kurstaki*	
Eyespotted bud moth	1A: carbaryl 1B: azinphos-methyl 5: spinosad	

1 This is a list of registered alternatives only (as of June, 2008). Health Canada does not endorse any of the alternatives listed. A number of the listed alternative active ingredients are in the process of being re-evaluated by the PMRA. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the *Re-evaluation Summary Table* (PMRA, 2008).

2 Insecticide and Acaricide Resistance Management Group Numbers are based on DIR 99-06, with updates from the Insecticide Resistance Action Committee (IRAC) website: www.irac-online.org/Crop_Protection/MoA.asp#area223. 1A = acetylcholinesterase inhibitors (carbamates); 1B = acetylcholinesterase inhibitors (organophosphates); 3 = sodium channel modulators; 5 = acetylcholine receptor modulators; and 11 = microbial disruptors of insect mid-gut membranes.

Comments Pertaining to Dietary Risk Assessment

Comments regarding the Canadian Maximum Residue Limit were received from registrants, growers and marketing associations by the PMRA in response to PRVD2007-16.

1.0 Comments

Request from California Table Grape Commission that the PMRA continue to maintain the Canadian Maximum Residue Limit (MRL) of 0.75 ppm for residues of diazinon on grapes.

Request from California Grape & Tree Fruit League that the PMRA continue to maintain the Canadian Maximum Residue Limits of 0.75 ppm for residues of diazinon on plums and 0.7 ppm on peach and nectarine.

Request that the PMRA continue to maintain the Canadian Maximum Residue Limit of 0.75 ppm for residues of diazinon for tree fruits.

Request from Cranberry Marketing Committee and the registrant that the PMRA continue to maintain the Canadian Maximum Residue Limit of 0.25 ppm for residues of diazinon on cranberries.

Response

The PMRA agrees to maintain the current MRLs for residues of diazinon on grapes, plum, prune, peach, nectarine, apricot, apple, pear, cherry and cranberries during their respective phase-out periods.

Comments Pertaining to Occupational Risk Assessment

General comments were received from the provinces of Ontario and British Columbia concerning the use pattern of diazinon.

1.0 Comment

The comments from the Ontario Ministry of Agriculture, Food and Rural Affairs indicate that while the largest raspberry planting in Ontario is 16 hectares, many are 2–4 hectares in size.

Response

The risk assessment for diazinon uses on raspberries was conducted using groundboom and airblast equipment and the subsequent area treated per day (ATPD) value. Applicators were assumed to treat five hectares per day using either groundboom or airblast equipment on any berries (excepting cranberries). These assumptions were based on the type of application equipment and the typical size of berry plots in Canada as described in available Statistics Canada surveys (1986–1997).

The risk assessment conducted by the PMRA used an ATPD of five hectares to encompass planting sizes for raspberries, blackberries, loganberries, gooseberries and currants. Given the conservatisms in the risk assessment, and the wide variety of plot sizes in berry farms, it is not expected that the risk assessment would underestimate the risk of exposure for applicators.

2.0 Comment

The British Columbia Ministry of Agriculture suggested that, to reduce occupational exposure concerns, the PMRA consider registering a fog application that can be used in growing rooms when all employees are not in the room.

Response

If the registrant is agreeable to such an application method and submits the appropriate supporting documentation, then the PMRA will be able assess the potential risk from fog applications. However, given the PMRA cannot impose new uses, it may be in the best interest of all parties to encourage a dialogue on this issue between the registrant and the appropriate grower groups.

3.0 Comment

The British Columbia Ministry of Agriculture suggested that the water soluble bags proposed for wettable powder formulations need to be of a size suitable for the agriculture commodities using this product.

Response

The PMRA agrees the packaging should be of a practical size that can accommodate growers. It is the role of registrant to determine the appropriate size of the water soluble package. It is suggested that the registrants should consult with grower representatives to ensure that their needs are met regarding packaging.

4.0 Comment

The British Columbia Ministry of Agriculture asked for confirmation that non-powered air purifying respirators equipped with an R- or P-series filter are the typical half or full face masks traditionally used by growers. Some tree fruit producers use powered air purifying respirators in which air passes through a purifying filter worn on a small body-pack. These respirators should be listed as acceptable options for respiratory protection.

Response

The typical half or full face masks traditionally used by growers should meet the requirements for a suitable purifying filter. To ensure the personal protective equipment requirements described on the labels are met, growers should carefully verify all their equipment specifications against label directions. The R- and P-series filters required are the baseline acceptable respiratory protection; powered air purifying respirators should more than meet the need for air filtration. Since not all

types of respiratory protection can be adequately described on the product labels, only the baseline requirement for R- or P-series filters will remain in the description of personal protection equipment required.

5.0 Comment

The majority of British Columbia farmers do not have closed mechanical transfer loading systems for mixing liquid formulations. The option of mixing and loading diazinon without a closed mechanical transfer loading system should be maintained.

Response

The PMRA recognizes that not all farmers have closed mechanical transfer loading systems for mixing liquid formulations. Thus, the label amendments in Appendix III identify the personal protective equipment farmers must wear if they are not using closed mechanical transfer loading systems for mixing liquid formulations.

6.0 Comment

There needs to be the option of using open cab tractors with diazinon applications. Closed cab tractors do not fit within many British Columbia orchards and only 2–3% of British Columbia tree fruit producers have closed cabs. Furthermore, only a small proportion of other producers have closed cab tractors. This requirement would not be economically feasible for producers.

Response

The PMRA recognizes that not all airblast applicators have closed cabs at this time. Thus, the label amendments identify the personal protective equipment applicators must wear if not in enclosed cabs.

7.0 Comment

A comment was received that encouraged the use of crop profiles in refining the risk assessment.

Response

The PMRA appreciates the offer of British Columbia crop profile information. This information is already available internally. Although crop profile information was considered during the review of diazinon, it cannot currently be used to further refine the occupational risk assessment. The current ATPD values are based on the application equipment used and have been refined using the typical farm size of the crop in question. In addition, the ATPD values must be applicable to growers across Canada.

8.0 Comment

The following comment was received from the Okanagan Cherry Growers Association regarding the use of closed cab tractors. The Association estimated less than 25% of cherry growers in the area currently own cab tractors and expressed concern that a loss of diazinon, which provides control with one spray, could result in increased exposure of operators to up to four sprays of other materials.

Response

As previously mentioned, the PMRA recognizes that not all applicators have closed cabs at this time. Thus, the label amendments identify the personal protective equipment applicators must wear if not in enclosed cabs.

9.0 Comment

The following comments were received from the Canadian Cranberry Growers Coalition regarding the delivery of diazinon through irrigation systems. The Coalition notes that one benefit of delivery through the irrigation system is that the application can be achieved in a relatively short time and when wind is lowest. Droplet size is much larger, thus minimizing any drift potential. Only one applicator with personal protective equipment is required and applications can be done at night to minimize exposure to bystanders.

Response

The PMRA recognizes the value of such a delivery system and would encourage the use of chemigation if appropriate. Unfortunately, the PMRA's assessment determined that the risk of exposure from this use exceeds the level of concern. It is proposed that the delivery of diazinon to cranberry crops via foliar application including the irrigation system be removed. This use may be considered for a longer term phase-out.

10.0 Comment

To minimize concerns about applicator safety, diazinon could be listed as a restricted class product requiring a pesticide applicators certificate.

Response

Applicator safety has been addressed through additional mitigation measures as well as eventual phase-out of many uses.

Comments Pertaining to Environment Risk Assessment

Comments were received by PMRA regarding environmental exposure and risk assessment with respect to soil drench and run-off of diazinon.

1.0 Comment

There appears to be an implicit assumption that exposure from soil drenches will be negligible. We agree that it will be less than for foliar applications; however, with a product of such high toxicity, it does not take much exposure before problems occur. Subsurface injection should be mandatory with this compound.

Response

The environmental risk assessment has concluded that the risks to birds and small wild mammals from soil drench application are acceptable due to minimal exposure from contaminated food items. According to the registered labels, the following crops have soil drench applications:

- Cane berries (raspberry, loganberry, blackberry) to control raspberry crown borer. The drench is applied to the plant crown.
- Cole crops (broccoli, Brussels sprouts, cabbage, cauliflower) to control root maggots. The drench is applied to the plant and surrounding soil as seedlings emerge or at planting for transplants.
- Onion to control onion maggots. The drench is applied in the furrow at planting (or seeding) to control larvae.
- Rutabaga and turnip to control root maggots. The drench is applied to the plant and surrounding soil as seedlings emerge.

The only soil drench application that can be subsurface injected is for onions. Soil drench applications on the other crops would not be efficacious if they were soil incorporated as the crops or emerging seedlings are treated in addition to the surrounding soil.

2.0 Comment

No measures whatsoever are proposed to reduce environmental exposure and risk. This is not considered acceptable.

Response

Those uses of diazinon found to be acceptable for continued registration will have appropriate label statements to mitigate environmental risks as well as appropriate buffer zones to minimize drift to non-target areas. These uses are listed in Appendix II.

3.0 Comment

It is suggested that, to minimize runoff from cranberry farms, a 72-hour hold for water be required after application of diazinon.

Response

Diazinon has a half-life in surface water of about 14 days; therefore, a 72-hour (3-day) hold for water to minimize runoff from cranberry farms may not be sufficient to eliminate the risk to aquatic organisms. As indicated above, to minimize surface water contamination when used on cranberries, all effluent water must be impounded and released only when levels of the active ingredient are ≤1 µg a.i./L. The 1 µg a.i./L level was chosen because the olfactory function of both the Atlantic and Chinook salmon may be affected by diazinon at concentrations as low as 1 µg a.i./L. Scholz et al. (2000)[5] found that the olfactory-mediated alarm responses and homing behaviours in Chinook salmon were significantly reduced at concentrations as low as 1 µg a.i./L.

In order to determine an appropriate holding time for impounded water, monitoring data on levels of diazinon over time in impounded water would be required. The submission of these data may allow for the determination of an appropriate holding time for impounded water. A second option would be to provide initial concentrations of diazinon in impounded water, which might enable the PMRA to model the dissipation of diazinon to determine the time required for residues to decline to levels below 1 µg a.i./L. If the generation of such data is being considered by stakeholders, the PMRA would welcome the opportunity to provide input into any proposed study protocol.

[5] Scholz, N.L, N.K. Truelove, B.L. French, B.A. Berejikian, T.P. Quinn, E. Casillas and T.K. Collier (2000). Diazinon Disrupts Antipredator and Homing Behaviours in Chinook Salmon (*Oncorhynchus tshawytscha*). *Canadian Journal of Fisheries and Aquatic Science*. 57: 1911–1918.

Appendix II Revised Phase-out Timelines for Diazinon

Use-site Category (USC)	Application Method	Phase-out	Crop/site
USC 4 forest and woodlots	Airblast	Longer term	Christmas tree plantations
USC 5 greenhouse food	Foliar spray	Short term	Mushroom houses, pepper*, tomato*
		Longer term	Tobacco (seedlings)
USC 8 livestock for food	Ear tag	No phase-out	Cattle
USC 10 seed treatment	Seed treatment	Short term	Bean (dry), bean (succulent, green), corn (sweet), onion*, pea (dry), pea (succulent, green), potato*, radish*, soybean, sugar beet*
USC 13 feed crops	Foliar spray	Short term	Clover*, green forage/hay*, grass*, pastures*, rangeland*
USC 14 terrestrial food crops	Drench	No phase-out	Blackberry, broccoli, Brussels sprouts, cabbage, cauliflower, loganberry, onion, raspberry, rutabaga, turnip
USC 14 terrestrial food crops	Foliar spray	Short term	Bean (dry, field), bean (green, succulent), beet, broccoli, Brussels sprouts, cabbage, cauliflower, collard cucumber, grape, hop, kale, kohlrabi, lettuce, melon, radish, parsley, pepper*, potato*, salsify*, spinach, squash, Swiss chard, tobacco*, tomato
		Longer term	Apple, apricot, blackberry, carrot, cherry, cranberry, currant, gooseberry, loganberry, onion, parsnip, peach, pear, plum*, prune*, raspberry, rutabaga, strawberry, turnip
	Granular	Short term	Broccoli, Brussels sprouts, cabbage, cauliflower, corn, rutabaga, tomato (broadcast application)
		Longer term	Carrot, onion, parsnip, radish, turnip
USC 16 non-crop areas	Foliar spray	Short term	Barrier strips*, ditch banks*, fence rows*, roadsides*, wastelands*
USC 27 outdoor ornamentals	Foliar spray	Short term	aralia, arborvitae, azalea, birch, boxwood, carnation, chrysanthemum, Euonymous, holly, ivy, juniper, oak, pine, rose, taxus

* Use is not supported by the technical registrants.

Appendix III Label Amendments for Products Containing Diazinon

The label amendments presented here do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Additional information on the labels of currently registered products should not be removed unless it contradicts the following label statements.

Canadian commercial end-use product labels must be amended to include the following statements to further protect workers and the environment.

I) The following statements must be included in a section entitled **PRECAUTIONS.**

TO ALL PRODUCT LABELS:

Keep the following personal protective equipment immediately available for use in case of emergency (a broken package, spill, or equipment breakdown): chemical-resistant coveralls, chemical-resistant gloves, chemical-resistant footwear and a NIOSH-approved respirator.

TO SPECIFIC APPLICABLE PRODUCT LABELS:

A. **Cattle ear tags:** Applicators must wear chemical-resistant gloves during application and removal of the device.

B. **Wettable powder formulations (must be packaged in water soluble bags):** Mixers/loaders must wear a long-sleeved shirt and long pants, socks and shoes and chemical-resistant gloves.

C. **Liquid formulations:** Mixers/loaders must use a closed mechanical transfer loading system for liquid products. Mixers/loaders must wear a long-sleeved shirt and long pants, socks and shoes, and chemical resistant gloves. If a closed loading system is not available, mixers/loaders must wear chemical-resistant coveralls over a long-sleeved shirt and long pants, chemical-resistant gloves, chemical-resistant footwear and a NIOSH-approved respirator.

D. **Applying using specific equipments:**
Applicators using **groundboom equipment** with a closed cab must wear a long-sleeved shirt, long pants, socks and shoes. Wear chemical-resistant gloves when leaving the cab for cleanup and repair.

Applicators using **airblast equipment** with a closed cab must wear a long-sleeved shirt, long pants, socks, and shoes. Wear chemical-resistant gloves when leaving the cab for cleanup and repair. If a closed cab is not available with airblast equipment, applicators must wear:

- Chemical-resistant coveralls over a long-sleeved shirt and long-legged pants
- Chemical-resistant hood
- A NIOSH-approved respirator
- Chemical-resistant footware plus socks
- Chemical-resistant gloves

Applicators using **handheld equipment**, including paintbrushes, must wear chemical-resistant coveralls over a long-sleeved shirt and long pants, head protection (if spray is directed upward), chemical-resistant gloves, chemical-resistant footwear and a NIOSH-approved respirator.

II) The following statements must be included in a section entitled **DIRECTIONS FOR USE.**

TO SPECIFIC APPLICABLE PRODUCT LABELS:

DO NOT apply this product directly to freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) or estuarine/marine habitats.

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers fine classification. Boom height must be 60 cm or less above the crop or ground.

Airblast application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

DO NOT apply by air.

Apply only when the potential for drift to areas of human habitation or areas of human activity (houses, cottages, schools and recreational areas) is minimal. Take into consideration wind speed, wind direction, temperature, application equipment and sprayer settings.

Buffer zones:

Use of the following spray methods or equipment **DO NOT** require a buffer zone: hand-held or backpack sprayer and spot treatment.

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.

Method of Application	Crop		Buffer Zones (metres) Required for the Protection of:			
			Freshwater Habitat of Depths:		Estuarine/Marine Habitats of Depths:	
			Less than 1 m	Greater than 1 m	Less than 1 m	Greater than 1 m
Airblast	Christmas tree plantation	Late growth stage	45	40	15	10
	Apple/pear	Early growth stage	70	65	40	30
		Late growth stage	60	55	30	20
	Stone fruit	Early growth stage	70	60	35	25
		Late growth stage	55	50	25	20

Restricted entry interval:

Crop	Restricted-entry interval (days)
Christmas tree	4
Tobacco (seedlings)	2
Apple	4
Pear	5
Stone fruit (apricot, cherry, peach, plum and prune)	4
Strawberry	4
Raspberry, blackberry, loganberry, gooseberry, currant	6
Cranberry	3
Brussel sprouts	4
Carrot, radish, parsnip	3
Onion	3
Rutabaga, turnip	4

TO PRODUCTS USED ON CRANBERRIES:

To minimize surface water contamination when used on cranberries, all effluent water must be impounded and released only when levels of diazinon are ≤1 µg a.i./L.

III) The following statements must be included in a section entitled **ENVIRONMENTAL HAZARDS.**

TO SPECIFIC APPLICABLE PRODUCT LABELS:

TOXIC to aquatic organisms.

TOXIC to birds.

TOXIC to small wild mammals.

TOXIC to bees exposed to direct treatment, drift, or residues on flowering crops or weeds. **DO NOT** apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.

TOXIC to certain beneficial insects. Minimize spray drift to reduce harmful effects on beneficial insects in habitats next to the application site such as hedgerows and woodland.

To reduce runoff from treated areas into aquatic habitats, avoid application to areas with a moderate to steep slope, compacted soil or clay.

Avoid application when heavy rain is forecast.

Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.

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